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First records of small squaregilled mayflies (Ephemeroptera, Caenidae) from the state of Roraima, Northern Brazil

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Abstract: New records and notes on the distribution of the family Caenidae from Roraima state, Brazil are provided. No previous records were known of this family from Roraima. Our study reports four species of *Brasilocaenis* and *Caenis*: *Brasilocaenis irmleri* Puthz, 1975, *Caenis chamie* Alba-Tercedor & Mosquera, 1999, *C. fittkaui* Malzacher, 1986 and *C. reissi* Malzacher, 1986. In addition, an unidentified species of *Latineosus*, based in a unique exuvia, was also found.

Key words: Caeninae; Brachycercinae; savannah; Neotropics; checklist

INTRODUCTION

Caenidae (Insecta: Ephemeroptera) is globally widespread, except for New Zealand, Antarctica, and various oceanic islands (Edmunds et al. 1976; Domínguez et al. 2006; Barber-James 2008). In the Neotropical Region, five genera and 32 species of Caenidae have been recorded (Barber-James et al. 2013; Molineri 2014; Lima et al. 2015; Angeli et al. 2016). In Brazil, there are 20 species of Caenidae recorded in two subfamilies and four genera: Caeninae (*Brasilocaenis* Puthz, 1975 and *Caenis* Stephens, 1836) and Brachycercinae (*Alloretochus* Sun & McCafferty, 2008 and *Latineosus* Sun & McCafferty, 2008).

The nymphs of this family can be easily distinguished by the operculated gills of tergum II, which are quadrangular and overlap on median line of body and have a dorsal Y-shaped ridge; the filamentous gills on abdominal segment I; and the absence of hind wing pads. Nymphs occur in a variety of water bodies, including ponds, lakes, streams, and rivers, mostly along the margins on sand with a thin layer of silt but also can be found aggregated in vegetation in areas of flow and in floating lentic plants (Edmunds et al. 1976; Brittain 1982; Edmunds and Waltz 1996; McCafferty et al. 1997; Francischetti et al. 2001).

Adults can be distinguished by their small and undivided eyes, a median lighter mark (ommation) present on mesonotum, hind wings absent with anal area of fore wings expanded, and forceps 1-segmented. The subimagos emerge in the early morning in some species and at nightfall in others, molting within minutes; the adult stage is brief, lasting only a few hours at most (Edmunds et al. 1976; Domínguez et al. 2006; Da-Silva and Salles 2012).

The northern region of Brazil has 13 records of Caenidae species, mainly confined to small areas in Acre, Amazonas, and Pará (Puthz 1975; Malzacher 1986; 1990; Angeli et al. 2016). Information regarding other states in the region remains virtually nonexistent. The state of Roraima occupies about 2.6% of Brazil (ITERAIMA 2005) and contains the largest continuous track of savannas in the Brazilian Amazon (Barbosa et al. 2005). The taxonomic knowledge of the Caenidae in the state of Roraima is unknown, with no records to this region until now. Here, we provide the first inventory of the family Caenidae for the state of Roraima.

MATERIALS AND METHODS

Collections were done between December 2015 and February 2016 in three sites in the state of Roraima (Figure 1).

The subimagos were captured with light traps from 18:00 until 05:40, and nymphs were captured with an aquatic entomological net. Male genital structures were examined in alcohol gel and then stored in alcohol. Nymphs were permanently mounted in Euparal. Identifications were based on keys in Domínguez et al. (2006) and also by comparisons against original descriptions. Diagnoses of each species are from Domínguez et al. (2006).

The material examined is housed in the Zoological Collection of Universidade de Roraima (UFRR), Boa Vista, Brazil.

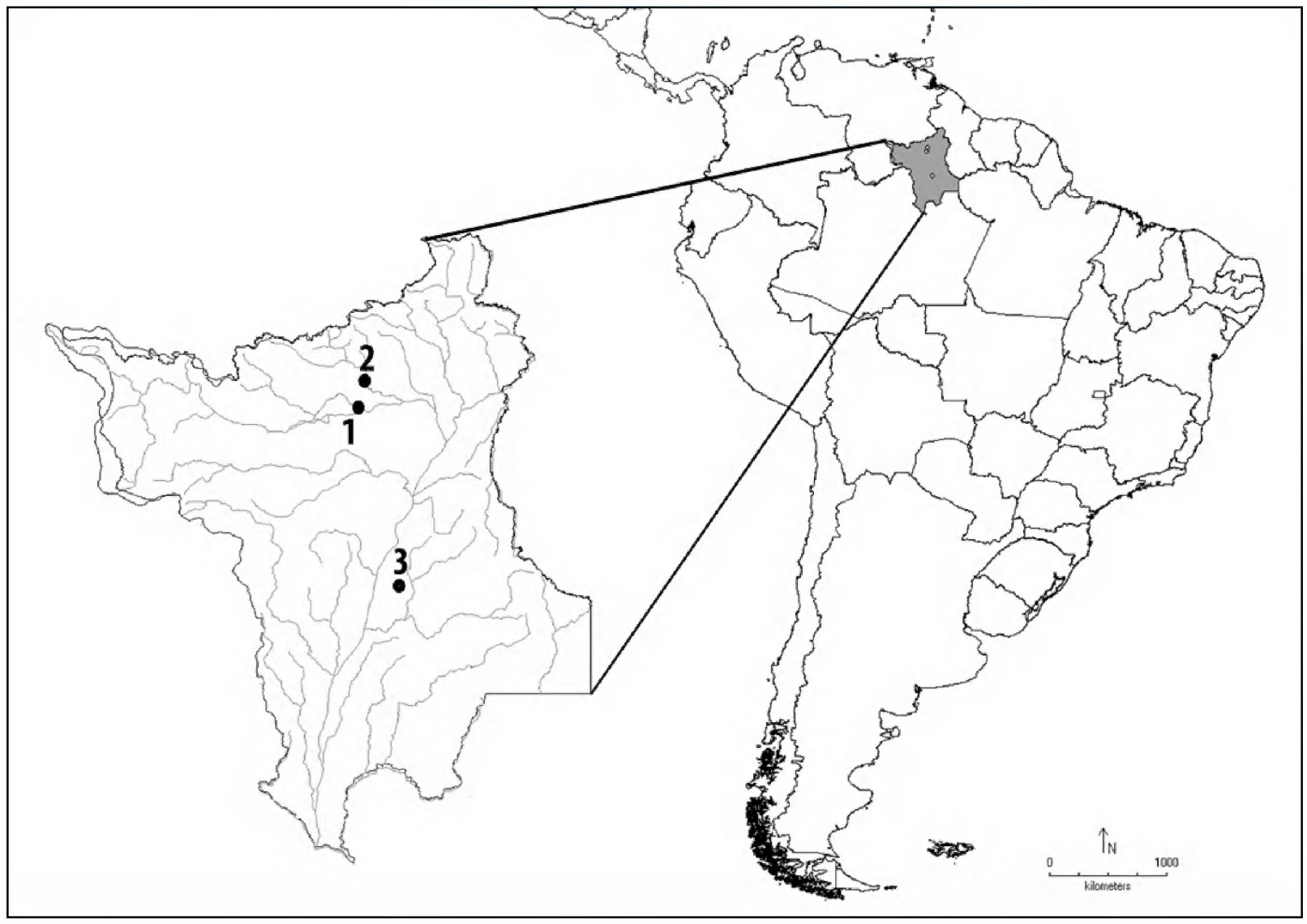

Figure 1. Map of the Roraima state with study sites: 1) Estação Ecológica de Maracá, Amajari municipality; 2) Amajari River, Amajari municipality; 3) Parque Nacional do Viruá, Caracaraí municipality.

RESULTS

We provide below a list of new records of mayfly species to the state. For each species we list geographical distribution data and provide a diagnosis.

Species list

Brasilocaenis irmleri Puthz, 1975 (Figures 2 and 3)

Brasilocaenis irmleri Puthz, 1975: 12 — Irmler, 1975: 348; Malzacher, 1986: 85 (male, female, nymph, egg); Malzacher, 1998: 3.
Brasilocaenis irmeli, Shimano et al. 2011: 245 (mispelling).

Diagnosis. Male Imago: 1) Body length of male 3.1–3.5 mm; 2) base of antennal flagellum slender; 3) male genitalia with forceps enlarged near base and narrow toward apex, apex of forceps curved inwardly; 4) meso- and metanota light brown, abdomen yellowish with darker spots on terga II–III and VII.

Previous distribution. Brazil: states of Amazonas and Mato Grosso. Colombia: Leticia.

Material. Two male imago (UFRR 95 and UFRR 96), Brazil, Roraima, Caracaraí municipality, Parque Nacional do Viruá, estrada perdida, first watercourse. Pennsylvania trap, 01°27′19.81″ N, 060°58′17.98″ W, 08.xii.2015, Boldrini, R. and Barroso, P.C.S. col.

Figures 2 and 3. *Brasilocaenis irmleri*. **2**, dorsal view. **3**, ventral view.

Figures 4–6. *Caenis chamie*. **4**, dorsal view. **5**, ventral view. **6**, genitalia (ventral view).

Caenis chamie Alba-Tercedor & Mosquera, 1999 (Figures 4–6)

Caenis chamie Alba-Tercedor & Mosquera, 1999: 61 — Lima et al. 2015: 3.

Diagnosis. Male Imago: 1) Body length of male 2.9–3.7 mm; 2) prosternal triangle with concave sides, and anteriorly broad; 3) finger-like process on abdominal tergum II absent; 4) lateral filaments of abdominal segments apparently short or lacking; 5) posterior margin of styliger plate more or less triangular; 6) lobes of penes well developed and rounded, a median groove with a pair of small indentations present; 7) forceps relatively long with basal and median projections; 8) abdominal terga with gray-brown pigments; in general aspect a yellowish brown species.

Previous distribution. Brazil: Pernambuco state. Colombia: Valle del Cauca.

Material. Ten male imagos (UFRR 98, UFRR 99, UFRR 100, UFRR 101, UFRR 102, UFRR 103, UFRR 104, UFRR 105, UFRR 106, UFRR107, UFRR 108) and three male imagos with genitalia mounted on slides (UFRR 92, UFRR 80, UFRR 81), Brazil, Roraima, Amajari, Rio Amajari, RR 203, below the bridge, 03°39.860′ N, 061°21.541′ W, 16–18.ii.2016, Boldrini, R. and Lima, L.R.C. col.

Caenis fittkaui Malzacher, 1986 (Figures 7 and 8)

Caenis fittkaui Malzacher, 1986: 91 — Salles et al. 2010: 304, Shimano et al. 2011: 245, Lima et al. 2015: 3.

Diagnosis. Male Imago: 1) Body length of male 2.8–3.7 mm; 2) prosternal triangle anteriorly closed and laterally with straight margins; 3) finger-like process on abdominal tergum II absent; 4) lateral filaments of abdominal segments apparently short or absent; 5) posterior margin of styliger plate almost straight; 6) lobes of penes fused, forming a rounded head, with a constriction in basal one-quarter, and small tubercles distributed on ventral surface; 8) apex of forceps sharp, sclerotized, and somewhat directed toward median line, surface with approximately 15–20 setae, forceps 9–11 times longer than median width; 9) abdominal terga diffusely tinted, segment II with a medial stripe and segment VII with black spots on margins; in general aspect a yellowish brown species.

Previous distribution. Brazil: states of Espírito Santo, Mato Grosso, Pernambuco, and Pará.

Figures 7 and 8. *Caenis fittkaui*. **7**, dorsal view. **8**, ventral view.

Figures 9–11. *Caenis reissi*. **9**, dorsal view. **10**, ventral view. **11**, genitalia (ventral view).

Material. One male subimago (UFRR 97), Brazil, Roraima, Amajari, Rio Amajari, RR 203, below the bridge, 03°39.860′ N, 061°21.541′ W, 16–18. ii. 2016, Boldrini, R. and Lima, L.R.C. col.

Caenis reissi Malzacher, 1986 (Figures 9–11)

Caenis reissi Malzacher, 1986: 95.

Diagnosis. Male Imago: 1) Body length of male 2.0–2.4 mm; 2) antennal bristle with short and asymmetric slightly dilated base; 3) prosternal triangle usually open anteriorly; 4) finger-like process on abdominal tergum II absent; 5) lateral filaments of abdominal segments apparently short or lacking; 6) posterior margin of styliger plate gently convex; 7) apical margin of penes elliptically curved; lobes of penes flat located on wide shaft, only weakly distinct; 8) apex of forceps rounded, although somewhat tapered toward apex and gently curved toward median line in basal third to half; surface with numerous recumbent setae; and 9) abdominal terga I–II with apical margins dark and two oblong lateral spots; in general aspect a light brownish yellow species.

Previous distribution. Brazil: Pará state.

Material. Six male imagos (UFRR 109, UFRR 110, UFRR 111, UFRR 112, UFRR 113, UFRR 114) and three male imagos with genitalia mounted on slides (UFRR 79, UFRR 93, UFRR 94), Brazil, Roraima, Amajari, Rio Amajari, RR 203, below the bridge, 03°39.860′ N, 061°21.541′ W, 16–18.ii.2016, Boldrini, R. and Lima, L.R.C. col.

***Latineosus* sp.**

Material. One exuvia mounted on slide (UFRR 78), Brazil, Roraima, Alto Alegre, Estação Ecológica de Maracá, Rio Uraricoera, near the float at the head office, 03°21′09.67″ N, 061°25′34.15″ W, 19–21.ii.2016, Boldrini, R. and Lima, L.R.C. col.

DISCUSSION

A total of 25 specimens and one exuvia belonging to three genera and five species were collected and recorded for the first time to state of Roraima. The nymphal exuvia of *Latineosus* was not possible to identify but probably represents a new species. Additional specimens are necessary to confirm its specific status.

Caenis chamie is known from all stages and appears to belong to the *pflugfelderi*-group of species as defined by Malzacher (2001) for *C. pflugfelderi* Malzacher, 1990 and *C. panamensis* Malzacher, 2001. This species shows some variation in the shape of male genitalia forceps, and is very similar to *C. pflugfelderi* Malzacher, 1990. However, it can be distinguished by having the apical margin of penes straight and the apophyses of the styliger sclerite pointed and straight. *Caenis reissi*, described from male imagos, belongs to the *reissi*-group Malzacher (1986, 2001), characterized by male genitalia with reduced, weak and uncoloured sclerites, often hardly recognizable.

Caenis fittkaui and *B. irmleri*, described from imagos of both sexes, nymphs and eggs in the original description (Irmleri 1975; Malzacher 1986), are characterized by male genitalia with strong, sclerotized, and apically pointed forceps. The presence of the last species represents the first record of the genus to the state of Roraima.

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